

SIM SCIENCE WORKING GROUP (SIMSWG)

***Thermal-Opto-Mechanical Testbed
23-24 April, 1998***

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CONTENTS

- FUNCTIONAL OVERVIEW
 - OBJECTIVE OF TESTBED
 - CONCEPTUAL DESIGN
 - MODEL VALIDATION PROCESS
- REQUIREMENTS
- IMPLEMENTATION PLAN
- CONCLUDING REMARKS

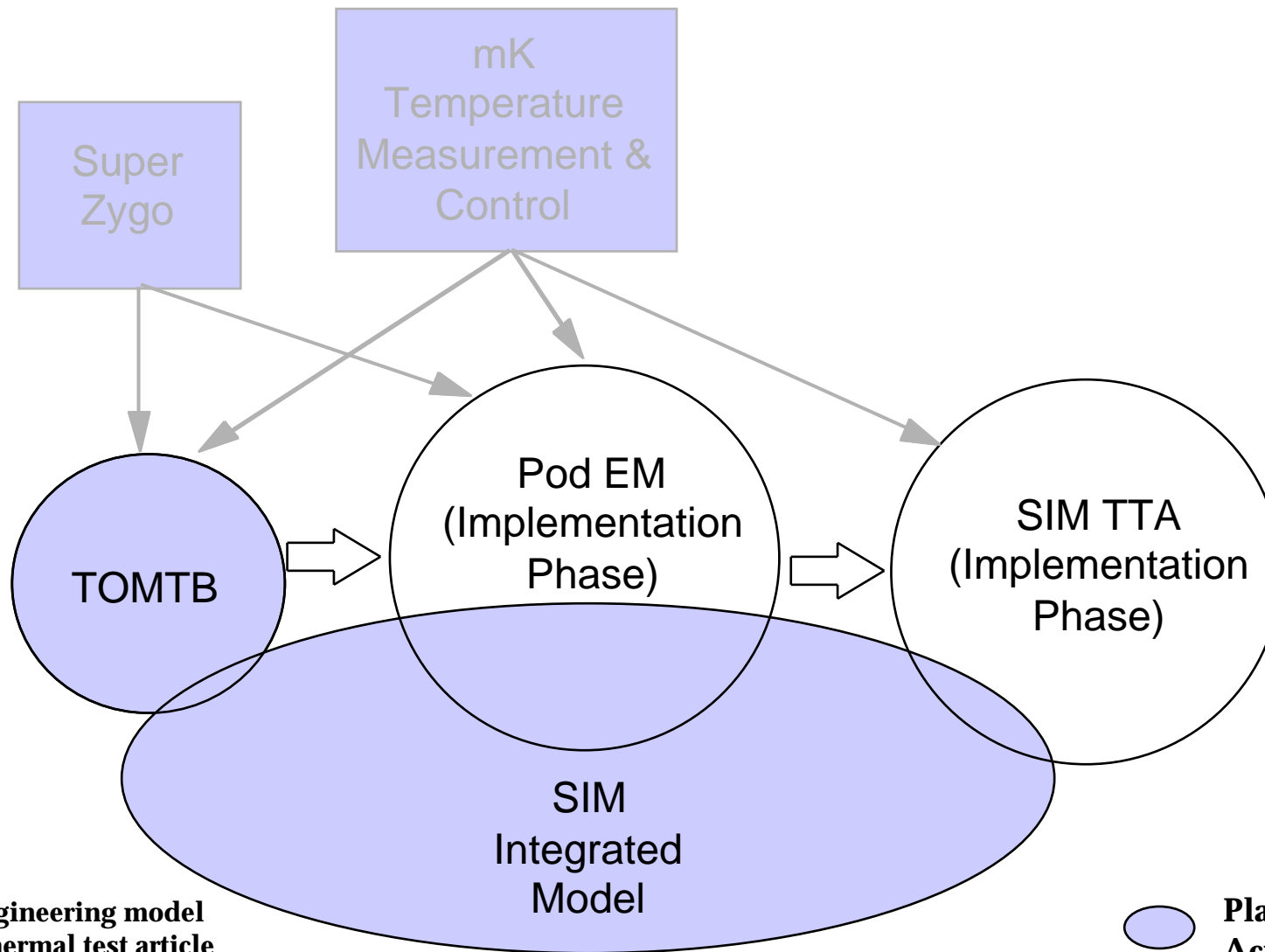
RECOMMENDED PROGRESSION FOR THE VALIDATION OF SIM THERMAL-OPTICAL INTEGRITY

S
I
M

Space
Interferometry
Mission

EM-engineering model
TTA-thermal test article

SIMSWG 23-24 April 98



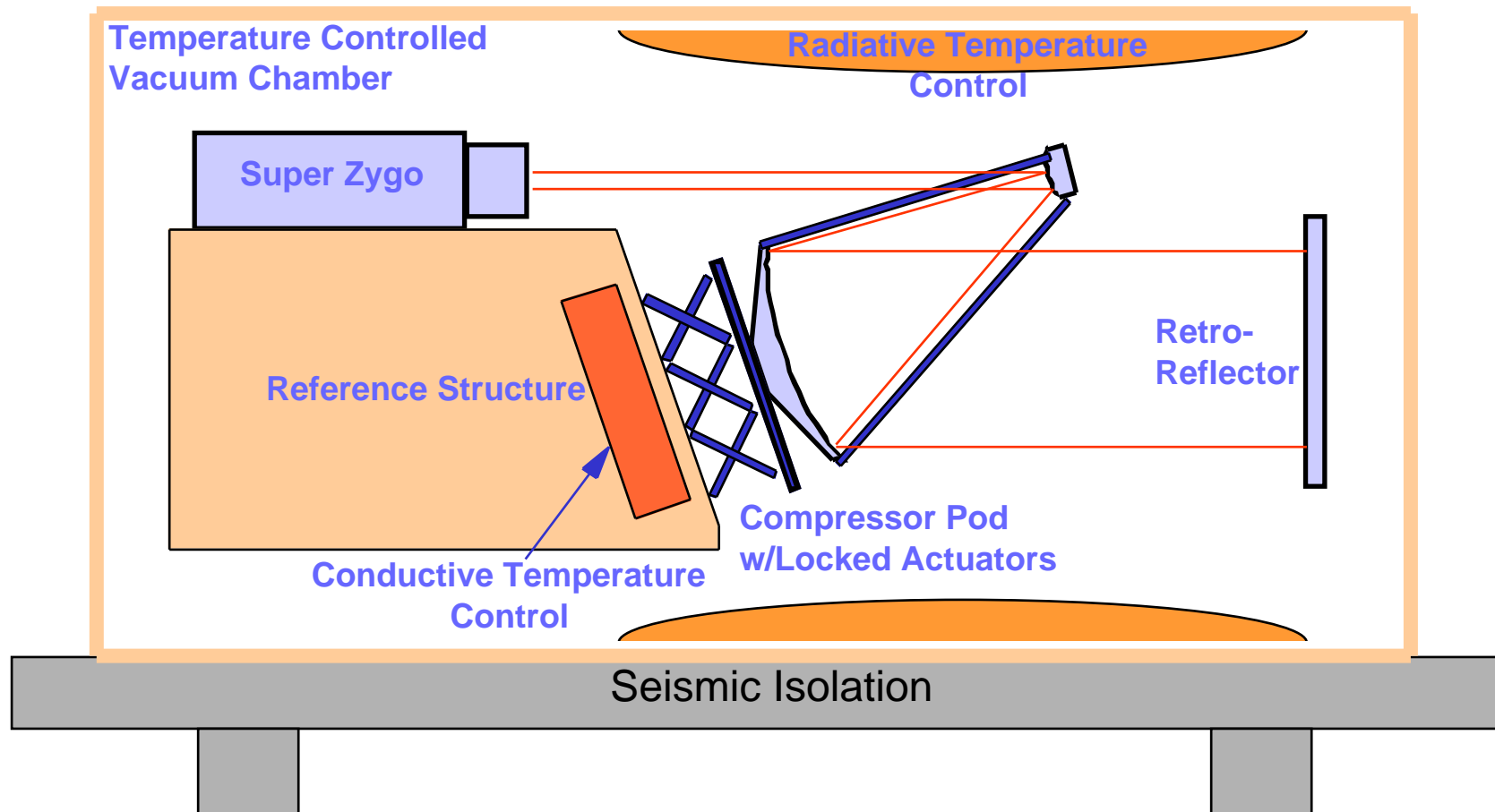
Planned
Activity

TOMTB

GYC : - 3

TOMTB CONCEPT

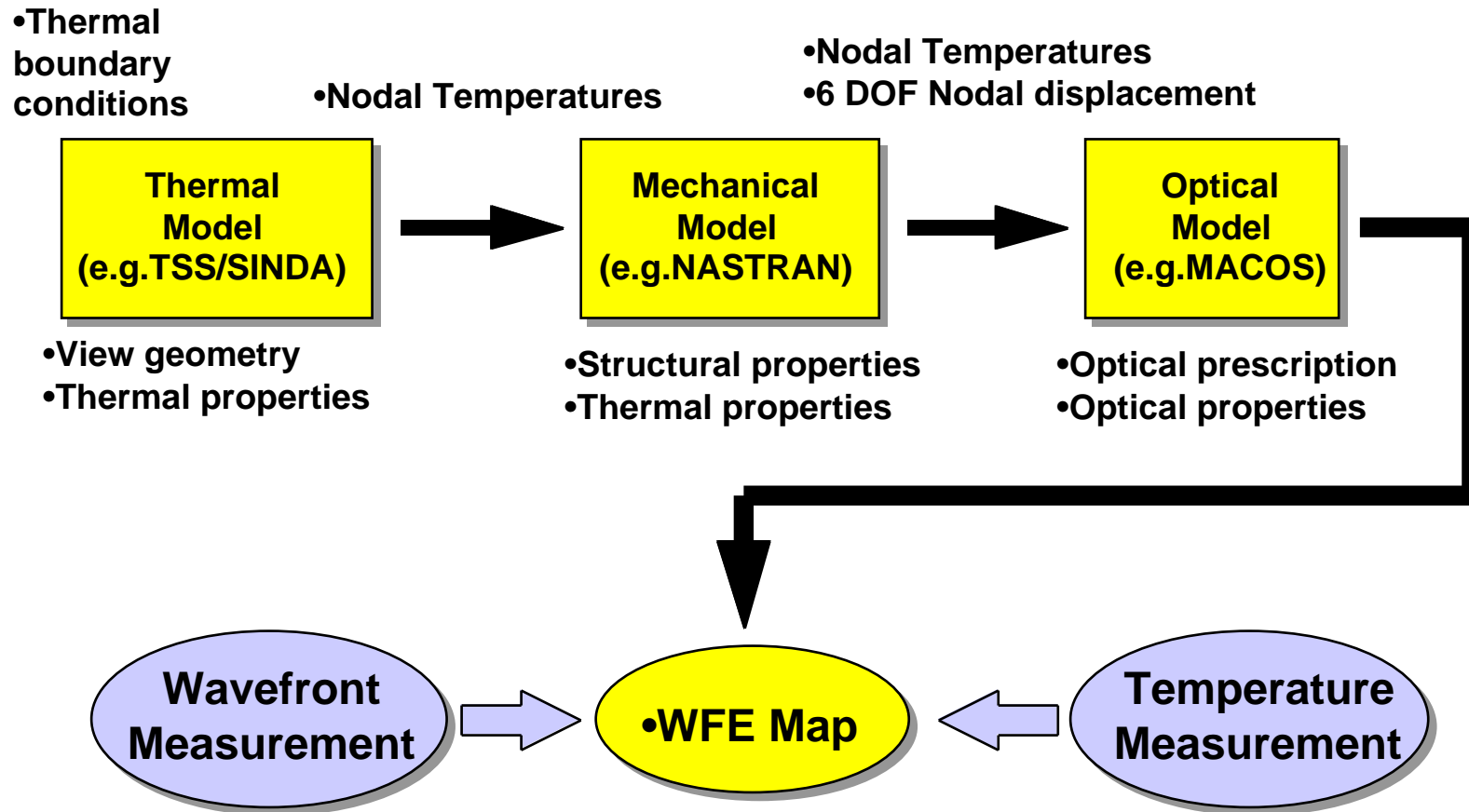
- Compressor wavefront interrogated by Zygo interferometer in double pass
- Simulated radiative and conductive temperature boundary conditions
- Provisions for active thermal control
- Independent means for monitoring of optical deformation and rigid body displacement



FUNCTION OF TESTBED ELEMENTS

	TOMTB	Pod EM	SIM TTA
	<ul style="list-style-type: none"> •Demonstrate thermal stability of compressor optics under a range of simulated flight conditions •Demonstrate ability to perform temperature control at mK level •Validate thermal-optical modeling approach 	<ul style="list-style-type: none"> •Validate thermal-optical performance of compressor pod design •Refine thermal-optical modeling approach 	<ul style="list-style-type: none"> •Validate thermal performance of SIM instrument
Integrated Modeling	<ul style="list-style-type: none"> •Predict testbed performance •Use testbed data to calibrate/refine model •Predict SIM performance 		

MODEL VALIDATION PROCESS



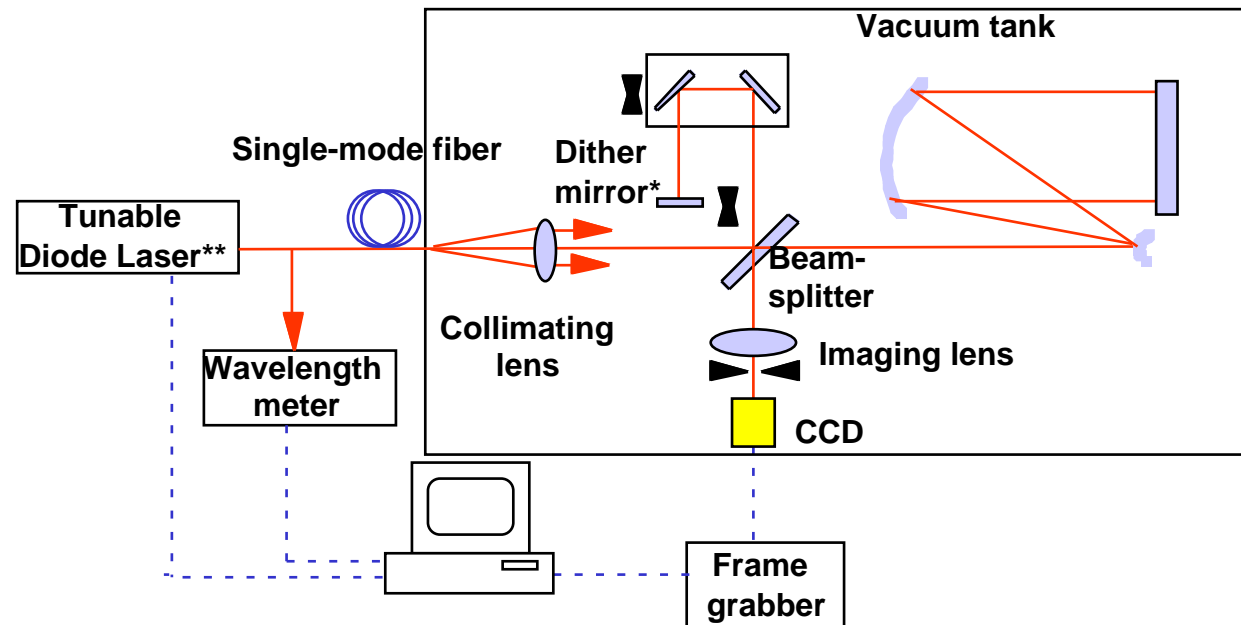
TESTBED REQUIREMENTS ARE DRIVEN BY THERMALLY INDUCED PATHLENGTH ERRORS

Error Source	Pathlength Error Allocation*	WFE In Double Pass	Compressor Thermal Constraints	Control Requirements
Despace	60 pm	525 pm	Change in soak temperature	40 mK
Deformation on primary mirror	30 pm	50 pm	Change in primary mirror thru-thickness temperature difference Average mirror temperature	2.6 mK 18-22 °C

*over 50 minutes

TOMTB REQUIRES CONTINUAL DEVELOPMENT OF SUPER-ZYGO FACILITY

Characteristics	Requirements	Current Status
Sensitivity	50-500 pm	~300 pm
Precision	10 pm	30 pm
Aperture	3 cm	5 cm



*existing configuration is based on pathlength scanning

**alternate scanning approach using wavelength modulation

TOMTB	FY 1998	1999	2000	2001	2002
SIM Instru. Milestones	Select IIP ▼	Start Flt Prelim Design ▼	SRR ▼	PDR/NAR ▼	CDR ▼
Requirement Definition	Req't Rev ■▲				
Facility & Experiment Design		PDR CDR ■▲▲			
Facility Procurements		LL Proc ■————			
Facility Test, Verification & Cal.			Test Readiness Rev ■▲		
Model Verification				Data Rev ■▲	

CONCLUDING REMARKS

- **Validation of SIM thermal integrity involves testbed demonstration of key technologies and integrated modeling**
 - TOMTB
 - Pod EM
 - Instrument TTA
 - Integrated Model
- **TOMTB configured to address thermal-optical modeling integrity with a critical subassembly (compressor pod)**
- **Validation efforts require continuing development of Super-Zygo facilities and mK temperature measurement/control**